

POLLUTION SURVEY TOWN OF KIRKLAND LAKE (MURDOCK CREEK)

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North-Eastern Region
R. E. Moore
Regional Director

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POLLUTION SURVEY
TOWN OF KIRKLAND LAKE
(MURDOCK CREEK)

July 1975
Timmins District
Municipal & Private Abatement
Northeastern Region

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INTRODUCTION

A sanitary survey was conducted in the Town of Kirkland Lake by the Ministry of the Environment on July 15 and 16, 1975, to determine what changes have taken place in the water quality of Murdock Creek since the installation of a sewage treatment plant in 1973. Residents in six unsewered areas within the study boundaries were interviewed in order to determine what methods of sewage disposal they use.

GENERAL INFORMATION

i) Background

For the purposes of this study, only the Kirkland Lake townsite and the surrounding residential areas were included. This portion of the community has a 1974 assessed population of 10,947. Development was stimulated in Kirkland Lake by the discovery of gold during the 1920's. The town is located on Highway #66, in the geographic Township of Teck.

ii) Weather

Prior to this survey, the weather was unusually hot and dry. The precipitation amounts in the following chart were obtained from the Earlton Airport. It has been assumed that the situation was similar in the Kirkland Lake area.

Month/Day	Precipitation In Inches
June 23	0
June 24	0
June 25	0
June 26	0
June 27	0
June 28	0
June 29	0
June 30	0
July 01	0
July 02	.64
July 03	0
July 04	Trace
July 05	Trace
July 06	0
July 07	.43
July 08	.01
July 09	0
July 10	.02
July 11	Trace
July 12	0
July 13	0
July 14	.02
July 15	0
July 16	0
Total	1.12

II TECHNIQUE

(1) Field Work

Interviews with residents living in unsewered areas were conducted by the three members of the survey team, to determine the methods of sewage disposal being utilized.

As well, the survey team walked the entire length of Murdock Creek, from the source to the location of Septic Tank #6, south of Woods Ave.. The creek was sampled for coliform bacteria at 18 points; various ditches and outlet pipes entering this watercourse were sampled at 8 points.

2) Handling of Samples

Bacteriological samples were kept packed in ice to avoid excessive growth of coliform bacteria which could cause unreliable sample results. These samples were shipped daily to the Provincial Health Laboratory in Timmins via the Ontario Northland bus.

Chemical and phenol samples were sent by train to the Ministry of the Environment Laboratory in Toronto.

3) Significance of Results

The level of coliform bacteria present has been used as an indication of the amount of pollution existing in the water source from which the sample was taken. Coliform organisms are a species of bacteria which normally inhabit soil and vegetation and are present in the faecal matter of humans and warm blooded animals. Recent pollution by sewage origin is indicated by levels exceeding 1000 total coliforms/100 mls and 100 faecal coliforms/100 mls. Human faecal matter is the major source of unnaturally high coliform levels. Total coliform counts of $80,000^+$ /100 mls coupled with faecal coliform counts of $8,000^+$ /100 mls are indicative of raw sewage.

The count of coliform organisms actually present may be in excess of 10 million/100 mls; the lower counts are due to the testing limits used in the laboratory.

The laboratory bacteriological examination procedure has been explained in Appendix I, under bacteriological examination.

(4) Sample Results

The results obtained from bacteriological examination are listed in Table I. Included are the sample point number and the location of each sample taken as well as the examination results.

Chemical analyses are listed in Table II. The location of each sample has also been placed in this table. The corresponding results of bacteriological examination have been included in this table to facilitate a comprehensive evaluation of the water quality at these sample points.

(5) Maps

Appended to this report is a map of the Town of Kirkland Lake. Murdock Creek sample points as well as those in other locations have been shown.

A small map showing the locations of the six unsewered areas in the town has been included within the body of the report.

III SANITARY WASTE DISPOSAL

(1) Sewered Area

Almost the entire Townsite of Kirkland Lake has been supplied with sanitary sewers, with the exception of 19 homes located in 6 different residential areas. Since November of 1973, sanitary wastes have been directed to the newly-constructed sewage treatment plant. From the start-up of the plant until April of 1974 an estimated volume of 41.9 million gallons of raw sewage was by-passed to Murdock Creek. Since that time, by-passing generally occurs only during overloading caused by heavy rains. In the event of a plant by-pass the sewage is directed into the large communal septic tank located immediately to the northeast of the treatment plant. Here the sewage receives some primary treatment before it is discharged from the tank into Murdock Creek. The plant which also discharges it's treated effluent to Murdock Creek can also by-pass sewage on Rand Avenue. Theoretically the plant has a 3 million gallon per day capacity; monthly averages indicate that the average daily flows are approximately 2.5 million gallons.

Before the installation of the sewage treatment plant in 1973, sanitary wastes produced by the community were collected in seven different communal septic tanks. The locations of these are shown on the map appended to this report. Five of these tanks discharged their effluent to Murdock Creek, a practice which was known to result in the high level of contamination formerly in the water in this creek. The sixth septic tank discharged into a ditch in the softball park situated north of Government Rd., and west of Water Street. Flow from this ditch discharged into the bush.

These septic tanks provided token treatment of the raw sewage by serving as sedimentation basins which facilitated the settling out of particulate matter and the partial clarification of the raw sewage. Bacterial content is virtually unaltered during this type of treatment process.

These septic tanks are no longer used. All the sanitary wastes are now handled by the sewage treatment plant. No evaluation of the operation of the new secondary treatment plant will be made in this report. The Town Works Department plans to remove the concrete tops from the old tanks and backfill them.

(2) Unsewered Area

Six different areas on the outskirts of the residential areas of Kirkland Lake contain a total of nineteen unsewered residences. These areas are shown on map I shown as the next page.

(i) George St. Area

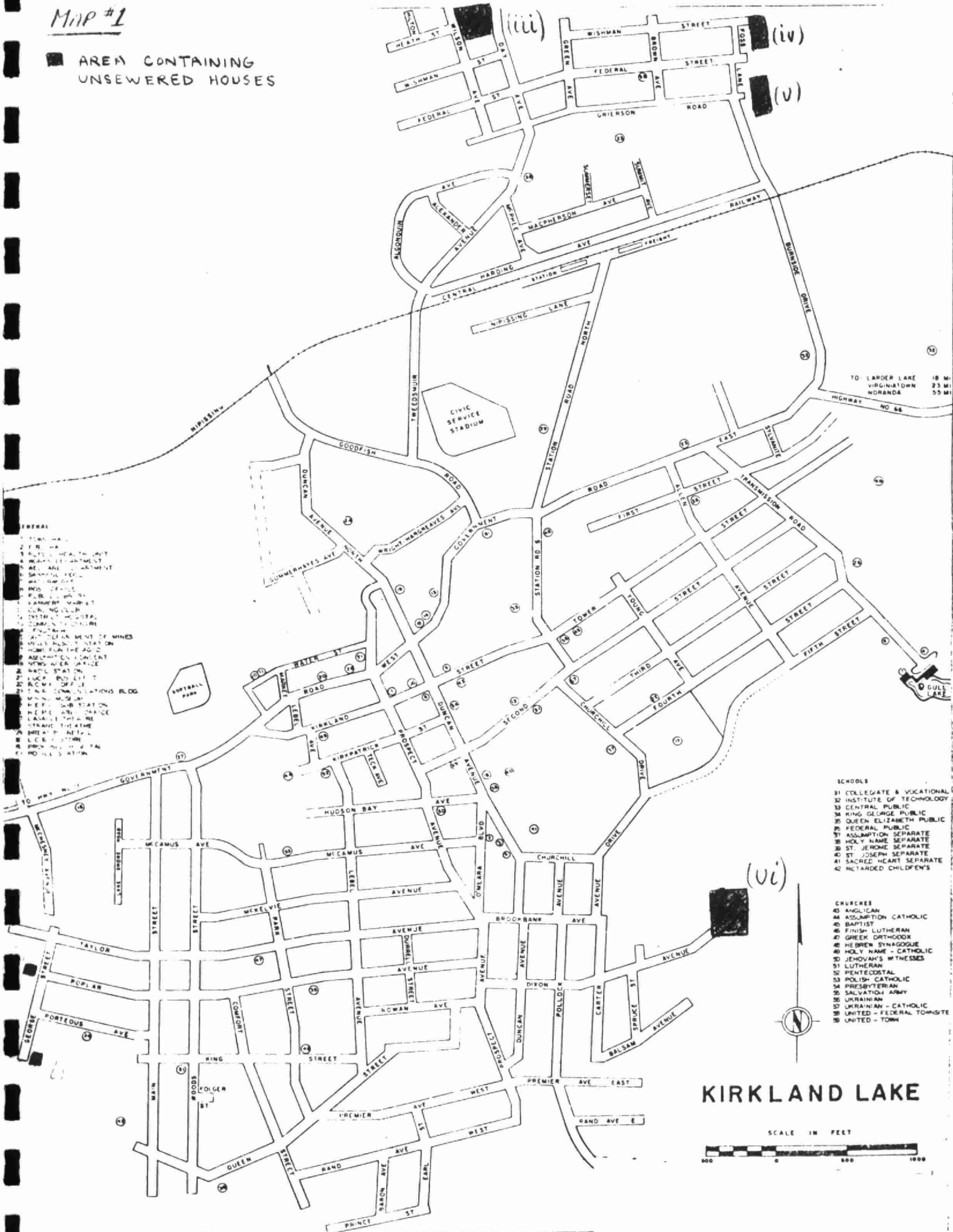
Two homes located at the southeast end of George St. are not connected to sanitary sewers. A single outdoor privy is used by the residents from both dwellings. Waste wash water which was clear and odour free is discharged into the bush south of George St.. These two houses are not on the town water supply network. Individuals carry their water from a tap on George St. just north of these two homes.

(ii) Poplar Street Area

On the west end of Poplar St. an unsewered construction company property uses a septic tank for sewage disposal. No outlet pipe or ditch was found to originate from this sewage disposal system. There is no evidence of any system malfunctioning. The town's communal water line services this building.

Map #1

AREA CONTAINING
UNSEWERED HOUSES



iii) Wilson-Day Avenue Area

Five homes in Wilson-Day Ave., area, in the northermost portion of Kirkland Lake are unsewered. Two homes on Day Ave., use a concrete septic tank, or sedimentation tank. No tile bed exists for this system; sewage is discharged into a small ditch, with flow extending in a northwesterly direction. The ground was unusually dry due to the previous weeks of hot weather; the effluent from the septic tank was almost immediately absorbed into the soil making it impossible to obtain a sample. The remaining three houses, located on the east side of Wilson Ave., reportedly have septic tanks lacking tile fields. A resident stated that discharge from the outlet pipes in these tanks flows in a northerly direction, joining with the effluent from the septic tanks previously mentioned. The survey team was unable to find the discharge from the Wilson Ave. septic tanks, so it is possible that underground pipes exist; however, the odour of sewage was strong in this vicinity.

iv) Foss Lane Area

Three unsewered homes are located east of Foss Lane. One residence uses a septic tank. The resident who was interviewed here was uncertain if a tile bed existed; no discharge or outlet pipe was located. The residence next door is serviced by a septic tank which has no tile bed. An outflow pipe discharges sewage into a small ditch to the rear of the house, allowing the raw sewage to flow onto the tailings area. Not enough liquid was present in the ditch to obtain a bacteriological sample. The resident was concerned about this problem, stating that it caused odour and that she felt it was potentially unhealthy. She also said that she hoped the communal sewage system would be extended to include this area. The survey team was unable to contact anyone in the third residence.

(v) Burnside - Grierson Area

East of Burnside Drive and at the eastern end of Federal and Grierson St., three homes are without municipal sewer connections. One residence uses a septic tank with no tile field; effluent is discharged to the same area. A desire for communal sewerage was expressed by the occupant. Another home uses an outdoor privy and disposes of waste wash water to the tailings area via a ditch. No one was available for an interview at the third home.

(vi) Dixon - Furlong St. Area

The last unsewered area containing 4 homes is situated on the southeastern outskirts of the town in the Dixon Ave. - Furlong St. vicinity. One residence uses a septic tank for sewage disposal. It was not known if the system included a tile bed; no pollution was found originating from this system. The residents in this dwelling connected their house to the communal water system at their own expense. Another home uses an outdoor privy. The resident stated that it was cleaned regularly, at which time wastes are removed to the dump. Wash water is disposed of in a ditch. Drinking water is carried from the tap situated on the eastern side of Furlong St. A third residence uses a septic tank and tile field; water is supplied from a connection to the communal system.

Murdock Creek

A total of 26 bacteriological, 6 chemical and 4 phenol samples were taken from Murdock Creek and its tributaries. Drainage for a large portion of eastern portion of Kirkland Lake as well as most of the southern part of the town flows into Murdock Creek.

The observations and sample results are outlined in the following paragraph. The creek is reviewed progressively from its origin to the area of the new sewage treatment plant.

Although the uppermost portion of the creek bed was dry, a sample (MC-1) was obtained at the first possible place, approximately 600 feet east of Nipissing Lake. At this location the creek is 2 to 3 feet wide, flows in a northerly direction and contains weeds and algae. The total coliform count was 160/100 mls and the faecal coliform count was 110/100 mls.

Another sample (MC-2) was acquired from the creek water near a storm sewer outlet which drains Northland Blvd. to the north of the creek. Oil was emanating from the storm sewer pipe. Downstream the water became very murky. The oil appears to be from the train track area, immediately to the north of Murdock Creek. Bacteriological examination yielded a total coliform result of 165/100 mls. Little change has occurred in the bacteriological quality of the creek.

Downstream the creek widens slightly to 5 to 6 feet. Another sample (MC-3) taken less than 300 feet downstream from MC-2 revealed no change in the coliform level. Approximately 100 feet downstream of this sample point, water flowing from a storm sewer, also draining the Northland Blvd. - train track area, was found to have the same bacteriological level as the creek water. The creek narrows to less than two feet in width past this location.

Murdock Creek then makes a 90 degree turn, flowing in a south-westerly direction. For an estimated 700 ft. the creek flows through underground pipes parallel to and on the west side of Burnside Drive.

A sample (MC-5) was obtained from a storm sewer outlet entering on the west side of Murdock Creek, south of Highway #66 where the Creek reappears. A total coliform count of 134/100 mls accompanied by a faecal coliform count of 30/100 mls showed an insignificant change in the coliform levels, as compared with coliform levels obtained from the creek upstream of this point. A great deal of litter is present in the creek at this location.

The same coliform level was present in a sample (MC-6) obtained near a storm sewer outlet at the east end of First St. Downstream at the east end of Tower St. 2 pipes cross the creek bed. Both pipes are approximately 18" in diameter. One is a water main and the other is a collector sewer which emanates from a manhole on the east bank of the ditch in which these pipes are exposed.

A sample (MC-7) taken immediately downstream from the pipe revealed a substantial rise in the coliform level. The results revealed a total coliform count of 4400/100 mls and a faecal coliform count of 2400/100 mls. This point was resampled on October 8, 1975 yielding a bacterial count of 8,000+ total coliform and 1300 faecal coliform organisms. It is possible that there is a leak in the pipe or that two connecting sections of pipe met in such a manner that a gap occurred.

Within 20 feet downstream of this pipe, 4 storm sewers empty into the creek. Unusually hot and dry weather prevailed before this survey was conducted. No flow was emanating from any of these pipes and it is unlikely that any water had been added to the creek from this source for 3 weeks. A sample (MC-8) taken downstream of these 4 pipes gave a total coliform count of 1400/100 mls and a faecal coliform count of 2400/100 mls.

The heavy pollution is undoubtedly of sewage origin, but it is unlikely that these storm sewer pipes are the source. The possible source of faecal pollution may be from what appears to be an overflow pipe emanating from a manhole on the east side of the ditch running into the creek. Approximately 800 feet further downstream, behind the Ontario Hydro property (MC-9), coliform levels were unaltered. At the northern corner of Power Line and Fifth St., the sample result (MC-20) remained unchanged.

The creek then travels through a park area via underground pipes. At an estimated distance of 800 feet downstream of sample point (MC-10) a creek joins Murdock Creek just after it has emerged from it's underground system. Four storm sewer pipes enter Murdock Creek in this vicinity. There was no evidence above ground of Gull Lake Creek. A sample was obtained from the 30 inch pipe (P-11) which is a by-pass for water from Gull Lake to Murdock Creek. This by-pass is only used during periods of high water to prevent flooding of the pumphouse. Reportedly there has been no significant flow in this line for several years.

Coliform examination proved to be exclusively faecal, 700/100 mls, indicating that this water is adding pollution to Murdock Creek. Approximately 80 feet downstream from P-11, a total coliform count of 225/100 mls (MC-12) was measured. Even with the addition of pollutants from the pipes upstream, here Murdock Creek was relatively unpolluted.

Downstream the creek increases from an average width of 2 feet to a width of 6 feet. A ditch flowing in a southeasterly direction from Allen Ave. enters the creek. Surprisingly high total and faecal coliform counts (MC-13) of 32,000/100 mls and 8,000⁺/100 mls respectively were obtained from this ditch. The ditch originates in an area of homes which are reportedly served by sanitary sewers. Town officials have suggested that the high levels are probably the result of sewage overflow from the collector sewer which runs parallel to the creek at this point. Apparently the sewer is unable to handle even peak daily flow during dry weather periods. Reportedly, facilities to correct this situation are included in the municipal capital works programme. Downstream, a mid-stream creek sample yielded an exclusively faecal coliform count of 280/100 mls. The creek seems to be diluting the pollution entering from the previously mentioned ditch.

A second ditch, also flowing southeast, enters Murdock Creek approximately 800 feet from the Allen St. Ditch. This ditch appears to originate in the Churchill Drive area. Bacteriological examination (MC-15) gave the following coliform results: 5500 total per 100 mls, 400 faecal per 100 mls.

The pipe which formerly served as the effluent line from septic tank #5 into Murdock Creek had been blocked off with sand bags at the time of the survey. A sample (MC-16) taken here yielded relatively low results of 4500/100 mls total coliform organisms and 140/100 mls faecal coliform organisms. It is impossible to ascertain whether the source of this pollution is from septic tank #5 or upstream. The creek then flows in a southwesterly direction through a residential area.

The width averages less than 2 feet; a large volume of litter was present in the creek throughout this area. On the southwest corner of Brookbank and Carter, a thick brown foam was observed on still portions of the creek. A chemical sample was acquired from this location. The total kjeldahl, which gives an indication of the amount of organic nitrogenous matter present, was within the acceptable range of 0.1 to 0.5 ppm. This signifies that high levels of organic nitrogen which would accompany sanitary sewage were not present at this point. Low nitrite and nitrate levels were also obtained.

Septic Tank #2 is located to the east of Murdock Creek, on a small westward flowing tributary of the creek which enters Murdock Creek more than 1200 feet downstream from Septic Tank #5. Septic Tank #2 was found to be empty. Although the bed of the creek leading from this tank to Murdock Creek was almost completely dry, enough liquid was present to acquire a sample (MC-17). The low coliform levels in this sample were indicative of normal surface runoff.

The creek flow changes to a westerly direction at this point at which it is joined by the tributary creek from Septic Tank #2. Approximately 800 feet downstream from the junction of the two creeks, Septic Tank #1 is situated (north of Premier Avenue). Slightly upstream from Septic Tank #1, bacteriological examination (MC-19) gave a total coliform count of 3100/100 mls and a faecal coliform count of 160/100 mls. This level seems to be typical of that present in the creek. About 10 feet downstream from this septic tank (from which there was no visible emission), the coliform level (MC-19) was unaltered.

Total kjeldahl, nitrite, and nitrate levels were also low enough to discount the presence of raw sewage. Beyond this point the creek had been dredged recently for a distance of 300 feet or more, extending the creek's width to 6 to 8 feet.

Between Queen St. and Rand Ave. West the creek flows through an underground pipe. A sample (MC-20) taken south of Rand Ave. where the creek reappears, yielded a total coliform count of 3500/100 mls and a faecal coliform count of 310/100 mls. Sewage is evidently gaining access to the creek; however, the amount is not excessive. Total kjeldahl, nitrite and nitrate levels remain low. Litter is again present in the creek.

Approximately 15 feet east of the reappearance of the creek on the south side of Rand Ave., a storm drain enters a narrow ditch which flows some 30 feet into Murdock Creek. A sample (C-21) from this source gave a comparatively low total coliform level of 96/100 mls with a faecal level of 6/100 mls. Nearby a narrow stream of black liquid that smelled strongly of sewage was observed. It was not possible at the time of the survey to determine the origin of this liquid. The coliform level at (C-22) was significantly higher here than in the nearby creek water or the outflow from the storm sewer - 19,000/100 mls total coliforms and 2,000/100 mls faecal coliforms.

Slightly north of Prince St., Murdock Creek is joined by Rand Creek. Results of a sample (RC-1) taken in Rand Creek an estimated 100 feet upstream of the junction of these two creeks were very low (300 total coliforms/100 mls and 112 faecal coliforms/100 mls). The bacteria probably originate from a remote source of sewage pollution.

Septic Tank #3 is located adjacent to Murdock Creek and near the corner of Comfort St. and Prince St. This septic tank is adjacent the sewage treatment plant and is used when by-passing of sewage is necessary. By-passing did not occur during our survey. Two of the three outflow pipes from this septic tank have been capped to prevent flow. At the time the survey was conducted, a small trickle of water emerged from the other pipe. Coliform examination of the water immediately downstream from the pipe yielded a total count of 2,600/100 mls and a faecal count of 800/100 mls. Total kjeldahl analysis revealed the first abnormally high level in the creek, 2.0 ppm.

Samples were acquired from the effluent of the sewage treatment plant. The effluent enters Murdock Creek southwest of Prince St. downstream of the developed area of the town.

The total coliform count (MC-24) was 1,200/100 mls accompanied by a faecal coliform count of 70/100 mls. Total kjeldhal was 7.8 ppm, indicating the presence of organic nitrogen. A nitrite level of 0.14 ppm and a nitrate level 4.5 ppm indicated that bacteria were performing the decomposition of nitrogenous matter. The total phosphorus level, 0.96 ppm, was appreciably higher than the value known to contribute to algal growth.

Septic Tanks #6 is located roughly 1000 feet downstream from the point at which the creek receives the effluent from the treatment plant. A black stream of sewage flowed from this tank in a westerly direction, but dried up before it reached Murdock Creek. Sample results (T-1) were 80,000⁺/100 mls total coliforms and 8,000⁺/100 mls faecal coliforms. A sample taken from Murdock Creek at this location gave total coliform results of 80,000⁺/100 mls and faecal coliform results of 1,100/100 mls.

The probable source of these elevated levels is the sewage treatment plant. Total kjeldahl, nitrite, nitrate and total phosphorus levels remain high in this portion of the creek.

Septic Tank #7, located in the softball park north of Government Rd. W., and west of Water St., is still discharging sewage to a ditch in the softball park. A sample was found to have a total coliform count of 80,000⁺/100 mls. This ditch discharges into the bush.

This past summer Septic Tank #4 was opened and filled with sand at the same time as reconstruction of Government Rd. took place.

During the survey the field staff observed that a clear odourless liquid was being discharged from a Government Rd. laundromat onto Water St.. The manager stated that the water originated in the steam presses, but bacteriological results of 80,000⁺/100 mls total coliforms and 8,000⁺/100 mls faecal coliforms indicate that untreated sewage is present in this water.

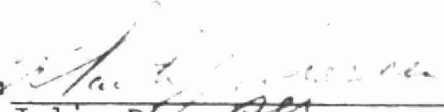
SUMMARY AND CONCLUSIONS

No ditches located in the sewered portion of the community contained heavy pollution of sewage origin. However, in at least 3 of the 6 unsewered areas within the town, ditches containing untreated sanitary wastes were found.

Although levels of pollution in Murdock Creek have decreased substantially since the installation of the sewage treatment plant and discontinuation of the use of the communal septic tanks, pollution is still entering the creek. The creek discharges into the Blanche River adding its pollution to that contributed to the river by the community of Swastika. The Blanche River flows into Otto Lake, then on a southbound course, discharging into Round Lake. Pollution in this river is known to be contributing to the eutrophication of Round Lake. Algal blooms in the water of this lake warranted a study of the problem by the Ministry of the Environment's Technical Support Section of the Northeastern Region has concluded that the Blanche River is adding a significant load of nutrients to Round Lake. It is hoped that the sewage treatment facilities in Kirkland Lake will significantly reduce the nutrient load being directed to Murdock Creek and will thereby encourage the improvement of water quality in Round Lake.

RECOMMENDATIONS

- 1) The Town should investigate the feasibility of providing sewer hook-ups for;
 - (1) 5 homes in the Wilson-Day Ave. area,
 - (2) 3 homes in the Foss Lane area,
 - (3) 3 homes, Burnside - Grierson area,
 - (4) 4 homes, Dixon - Furlong St. area.
- 2) The Town should investigate the cause of increased bacteriological counts upstream of the east end of Tower Street where sewage may be escaping from the 18" sewer into Murdock Creek.
- 3) The Town should also establish if sewage from a manhole on the east side of the ditch enters the creek near the Gull Lake storm sewer and correct the situation should it exist.
- 4) The Town should establish that the work proposed to upgrade the inadequate trunk sewer along the creek in the Allen Avenue vicinity will correct the situation which presently results in the bypass of untreated sewage into Murdock Creek.
- 5) The Town should establish the source of the narrow stream of foul smelling black liquid that was entering the creek just downstream of Rand Ave. and have it diverted from the creek.
- 6) The Town should establish why there is a slight discharge from Septic Tank #6, and arrange to have any inflow directed to the sewage treatment plant and the tank removed from service.
- 7) The sewage presently flowing into Septic Tank #7 (north of Government Rd. W. and west of Water St.) should be directed to the sewage treatment plant and the tank removed from service.
- 8) The laundromat on Government Rd. should be fully connected to the municipal sewer system.

Prepared By: 

Julie Dixon
Environmental Officer

Approved By: 

G. W. Scott
District Officer

APPENDIX I

SIGNIFICANCE OF LABORATORY ANALYSIS

Bacteriological Examination
Total Kjeldahl Nitrogen
Nitrite Nitrogen
Nitrate Nitrogen
Total Phosphorus
Phenols
Biochemical Oxygen Demand

APPENDIX I

SIGNIFICANCE OF LABORATORY ANALYSIS

Bacteriological Examination

The presence of coliform bacteria in water is used as an indication of the amount of existing pollution. Faecal coliform counts greater than 100/100 mls accompanied by total coliform counts exceeding 1000/100 mls denote that contamination of sewage origin has occurred.

The Ontario Ministry of Health Laboratory which performed the bacteriological analysis employs the Membrane Filter (M.F.) technique of examination. A membrane with small pores is used to filter a known volume of water. The filter is placed in a culture medium which favours the growth of the organism for which the sample is to be examined. After an incubation period the number of colonies of bacteria present are counted, allowing the determination of the number of organisms present in the original water sample.

CHEMICAL ANALYSIS

Total Kjeldahl Nitrogen

Total Kjeldahl nitrogen is a measure of the organic nitrogen plus the inorganic free ammonia present in a sample. Nitrite and nitrate nitrogen measurements are not included. The difference between the total kjeldahl and the free ammonia yields the amount of organic nitrogen present. The normal range for total kjeldahl is 0.1 to 0.05 ppm.

Nitrogen is converted during a sequence of biochemical reactions from the organic to the nitrite and then nitrate forms. The relative concentrations of these compounds can be used as an indication of how far these reactions have progressed. A high Kjeldhal accompanied by low nitrite and nitrate levels may indicate

a recent input of sewage. The presence of organic nitrogen in the sewage indicates that it has not yet had sufficient time to decompose to the more highly oxidized products in the nitrogen cycle.

Nitrite Nitrogen

Nitrite is an intermediate substance formed by autotrophic nitrifying bacteria during the decomposition of organic nitrogen and prior to the formation of nitrate. Since nitrite is highly unstable, bacteria rapidly convert it to other compounds. Nitrite levels exceeding 0.02 ppm denote that bacterial action is taking place.

Nitrate Nitrogen

Bacteria which oxidize nitrite form nitrate, the end production in the decomposition of organic nitrogen. The relative concentration of nitrate signifies to what extent organic nitrogenous matter has been broken down. High nitrate levels are undesirable in drinking water supplies because they contribute to methemoglobinemia in infants; high levels of nitrate in surface waters serve to promote undesired algal growth. A low concentration would be 0.1 ppm, with a moderate concentration in the range of 0.1 to 1.0 ppm; a high concentration would exceed 1.0 ppm.

Total Phosphorus

To maintain the balance between plant and animal life, a certain amount of phosphorus is essential. However, unnaturally high inputs of phosphorus from sources such as fertilizers, synthetic detergents and sewage promote algal growth, seriously decreasing the quality of the water. Levels of inorganic phosphorus greater than 0.01 ppm are known to contribute to the development of algae.

Phenols

Phenolic substances in a water sample generally originate from petroleum products gaining access to watercourses from industrial pollution. Phenol levels for domestic water supplies must not exceed 1 ppb; acceptable limits for surface water supplies must not be greater than 20 ppb.

Biochemical Oxygen Demand (BOD)

Chemical reactions performed by bacteria during the decomposition of organic matter in the water deplete the amount of dissolved oxygen available. When untreated sewage is discharged to a watercourse, large volumes of organic matter are added. To measure the biochemical oxygen demand, the sample is aerated, sealed and incubated at 20°C for a five day period. The residual oxygen consumed is roughly proportional to the amount of biodegradable organic matter present. BODs higher than 3 mg/l indicate that a large quantity of oxygen will be required for stabilization and that a proportionally large volume of organic matter is present. Excessive oxygen demands will result in the depletion of oxygen levels in the receiving stream and the possible onset of septic conditions.

APPENDIX II

SAMPLE RESULTS

TABLE I - Bacteriological Results - Murdock Creek

TABLE II - Bacteriological Results - Various locations - Town of
Kirkland Lake

TABLE III - Chemical Analysis Results

TWP. OF TECK
TOWN OF KIRKLAND LAKE
TABLE I - BACTERIOLOGICAL EXAMINATION OF MURDOCK CREEK

Sample Number	Location	July 15, 1975		1968 Results	
		Coliform Count Per 100 mls		Coliform Count per 100 mls	
		Total	Faecal	Total	Faecal
MC-1	Approximately 50 ft. Downstream from Source	160	110		
MC-2	At First Storm Sewer Outfall From Northland Blvd.	165	56	2800	600
MC-3	Approx. 600 feet from source	116	40	2800	600
MC-4	At Second Storm Sewer Outfall from Northland Blvd.,	110	38		
MC-5	Sample from Storm Sewer on West Side of Creek, South of Hwy #66	134	30		
MC-6	Storm Sewer at West End of First Street	550	28		
MC-7	Just Downstream From 2 Pipes At Foot of Tower St. (Pos. Leaking sewer pipe present)	4400	1700	1500	200
MC-8	20 ft. Downstream From MC-7, Past 4 storm Sewer Pipes	19000	2400		
MC-9	Behind Hydro	4300	1000		
MC-10	Corner of Powerline and Fifth	2800	1500		
P-11	Creek Which Flows From Gull Lake	700	700		
MC-12	80 Ft. Downstream From Gull Lake Creek Entrance	225	86		
MC-13	Ditch entering Creek From NW. (see Map)	32000	8000 ⁺		
MC-14	Sample From Creek, Approx. 800' Downstream From Gull Lake Creek	280	280		
MC-15	Ditch Entering Creek From N.W. (see Map)	5500	400		
MC-16	Near Blocked Off Outflow Pipe From Septic Tank #5	4500	140	220	
MC-17	Taken Past Septic Tank #2 (On Creek Which Flows Into Murdock Creek)	15	2		
MC-18	Before Septic Tank #1	3100	160		
MC-19	10' Past Septic Tank #1	3000	120		

TOWN OF KIRKLAND LAKE

TABLE III - CHEMICAL ANALYSES (July 15, 1975)

<u>Sample Number</u>	<u>Location</u>	Total Kjeldhal mg/a as N	NO ₂ mg/l as N	NO ₃ mg/l as N	Total P mg/l as P	Cl mg/l as U	Phenol - mg/ml	Bacteriological Total #100 mls	Faecal #100 mls
MC-16A	Murdock Creek, Corner of Brookbank and Carter	.35	.004	.04	.019	18	1		
MC-19	10' Past Septic Tank #1	.42	.006	.04	.027	19	-	3000	120
MC-20	South of Rand Ave.	.43	.007	.08	.030	19	2	3500	310
MC-23	Before Sewage Treatment Plant	2.0	.021	.18	.37	50	-	2000	800
MC-24	Past Sewage Treatment Plant	7.8	.14	4.5	.96	38	14	1200	70
MC-26	Past Sewage Treatment Plant	6.4	.18	3.8	1.5	31	4	8,000+	8,000+
BB-1	Ditch in Ball Park	1.2	.02	.02	.48	267	-	8,000+	8,000+



- LEGEND**
- OBU-582-62 — STREAM SAMPLING POINT SHOWING MILEAGE
 - OBU-582-27 — OUTFALL SHOWING STREAM AND MILEAGE
 - O — TYPE OF OUTFALL
 - D — DRAINAGE OR DITCH
 - T — TREATMENT PLANT EFFLUENT
 - W — STORM SEWER
 - — SEPTIC TANK

TOWNSHIP OF TECK
KIRKLAND LAKE

TOWN OF KIRKLAND LAKE
(TOWNSHIP OF TECK)
WATER POLLUTION SURVEY
1968 & 1975

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